

***IN THE UNITED STATES PATENT AND TRADEMARK OFFICE  
BEFORE THE BOARD OF APPEALS AND INTERFERENCES***

In re Application of: Choudhary, Tushar A., et al.

Serial No.: 10/625,366

Group Art Unit: 1754

Filed: July 23, 2003

Examiner: Cam N. Nguyen

For: DESULFURIZATION AND NOVEL PROCESS FOR SAME

***APPELLANTS' BRIEF ON APPEAL***

Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

Sir:

In response to the Notice of Appeal, which was mailed on April 2, 2007, and the Notice of Non-Compliant Appeal Brief, which was mailed on July 5, 2007, Appellants respectfully submits this Appeal Brief. Appellants respectfully request that the claims in question be allowed.

Following are the requisite statements under 37 C.F.R. § 41.37:

***Real Party in Interest***

ConocoPhillips Company, formerly known as Phillips Petroleum Company, is the assignee of record of the above-captioned Application and, thus, is the real party of interest in this Appeal.

***Related Appeals and Interferences***

It is believed that there are no appeals or interferences, which will directly affect or be directly affected by or have a bearing on the Board Decision on this Appeal.

***Status of Claims***

This application was originally filed with 56 claims. Claims 37 – 56 were previously withdrawn as being drawn to a non-elected invention. Claims 57 – 64 were previously added. Therefore, claims 1 – 36 and 57 – 64 are the claims being appealed, with claims 1 and 16 being in independent form.

***Status of Amendments***

All amendments submitted by Appellants have been entered.

***Summary of the Claimed Subject Matter***

The invention of independent claim 1 is directed to a method for the production of a composition, wherein the method comprises the steps of admixing: 1) a liquid, 2) a zinc containing compound, 3) silica containing material, 4) alumina, and 5) a promoter so as to form a mixture thereof (*See* application, page 6, lines 3 – 5, *see also* application page 17, lines 3 – 17); drying the mixture so as to form a dried mixture (*id.*, page 6, line 6); calcining the dried mixture so as to form a calcined mixture (*id.*, page 6, line 7, *see also* page 20, lines 11 – 22 and page 21, lines 1 – 17); reducing the calcined mixture with a reducing agent under conditions to produce a composition having a reduced valence promoter content therein (*id.*, page 6, lines 8 – 10, *see also id.*, page 21, lines 18 – 22 to page 22, lines 1 – 6); and recovering the composition (*see id.*, page 6, line 11).

The invention of independent claim 16 is directed to a method for the production of a composition, wherein the method comprises the steps of admixing: 1) a liquid, 2) a metal containing compound, 3) a silica containing material, 4) alumina, and 5) a first promoter so as to form a mixture thereof (*see* application, page 6, lines 14 -16, *see also* application, page 23, lines 5 – 13); drying the mixture so as to form a dried mixture (*see id.*, page 6, line 17); incorporating a second promoter onto the dried mixture to form an incorporated mixture (*see id.*, page 6, lines 18 – 19, *see also id.*, page 24, lines 18 – 22 to 25, lines 1 – 22, page 26 lines 1 - 2); drying the incorporated mixture so as to form a dried incorporated mixture (*see id.*, page 6, lines 20 – 21); calcining the dried incorporated mixture so as to form a calcined incorporated mixture (*see id.*, page 7, lines 1 – 2); reducing the calcined incorporated mixture with a reducing agent under conditions to produce a composition having a reduced valence promoter content therein (*see id.*, page 7, lines 3 – 5); and recovering the composition (*see id.*, page 7, line 6, *see also* page 26, lines 3 – 10).

#### ***Grounds of Rejection to be Reviewed on Appeal***

Claims 1 – 14, 16 – 35, and 57 – 64 stand rejected under U.S.C. 103(a) as being unpatentable over Sughrue et al. (U.S. Patent No. 6,254,766).

Claims 15 and 36 stand rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Sughrue et al, (U.S. Patent No. 6, 254, 766).

#### ***Arguments***

##### **A. Summary of U.S. Patent No. 6, 254,766 issued to Sughrue et al.**

Sughrue discloses a method for making absorbent composition, which

entails combining zinc oxide, silica and alumina in appropriate proportions by any suitable manner which provides for the intimate mixing of the components in order to provide a substantially homogenous mixture (*see* Sughrue, column 5, lines 1 – 6). The mixture is then particulated, dried and calcined (*see id.*, column 5, lines 25 – 26) then the particulate can be impregnated with a nickel oxide compound or a nickel oxide precursor (*see id.*, column 5, lines 31 – 33). The composition is then subsequently dried and calcined, and then reduced with a reducing agent, preferably hydrogen (*see id.*, column 5, lines 34 – 39).

### **B. Summary of Arguments**

Applicants respectfully submit that the Examiner's rejections should not be sustained because:

1. the Examiner has failed to identify a prior art reference or combination of references that teach or suggest each limitation of claim 1; and
2. the Examiner has failed to identify a prior art reference or combination of references that teach or suggest each limitation of claim 16.

### **C. Legal Discussion of Obviousness**

Obviousness can be a problematic basis for rejection because the Examiner, in deciding that a feature is obvious, has the benefit of the Applicants' disclosure as a blueprint and guide. In contrast, one with ordinary skill in the art would have no such guide, in which light even an exceedingly complex solution may *seem* easy or obvious. Furthermore, once the obviousness rejection has been made, the applicant is in the exceedingly difficult position of having to prove a negative proposition (ie, non-obviousness) in order to overcome the rejection. For these

reasons, MPEP § 2142 places upon the Examiner the initial burden of establishing a *prima facie* case, which requires, among other things, that there be identified some motivation or suggestion in the prior art or in the knowledge of one of ordinary skill to modify the reference or to combine reference teachings. If the Examiner fails to establish the requisite *prima facie* case, the rejection is improper and will be overturned. *See In re Rijckaert et al*, 28 USPQ2d 1955, 1956 (Fed. Cir. 1993). Only if the Examiner's burden is met does the burden shift to the applicant to provide evidence to refute the rejection.

More specifically, three criteria must be satisfied in order to establish a *prima facie* case of obviousness: (1) there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine their teachings; (2) there must be a reasonable expectation of success; and (3) the prior art reference (or combination of references) must teach or suggest all the claim limitations. *See* MPEP § 706.02 (j), citing *In re Vaeck*, 20 USPQ2d 1438 (Fed. Cir. 1991). Furthermore, “[t]he mere fact that the prior art may be modified in the manner suggested by the Examiner does not make the modification obvious unless the prior art suggested the desirability of the modification.” *In re Fritch*, 23 USPQ2d 1780, 1783 – 84 (Fed. Cir. 1992) (reversing an obviousness rejection where there was no suggestion to modify a prior art lower strip to make it entirely flexible as required by applicants claims toward a flexible landscape edging strip); *see also In re Gordon*, 221 USPQ2d 1125, 1127 (Fed. Cir. 1984). Additionally, “if the proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose,

then there is no suggestion or motivation to make the proposed modification.” MPEP § 2143.01. Further yet, if the proposed modification or combination of the prior art would change the principle of operation of the prior art invention being modified, then the teachings of the references are not sufficient to render the claims *prima facie* obvious. *In Re Gordon*, 733 F. 2D 900, 221 USPQ 1125 (Fed. Cir. 1984).

Meeting this initial burden, the Examiner “cannot use hindsight reconstruction to pick and choose among isolated disclosures in the prior art to depreciate the claimed invention.” *In re Fine*, 5 USPQ2d 1596, 1600 (Fed. Cir. 1988). There are three possible sources for a proper motivation to combine references: “the nature of the problem to be solved, teachings of the prior art, and the knowledge of persons of ordinary skill in the art.” MPEP § 2143.01 (citing *In re Rouffet*, 149 F.3d 1350 (Fed. Cir. 998)). Thus, “[m]easuring the claimed invention against the standard established by § 103 requires the oft-difficult but critical step of casting the mind back to the time of invention, to consider the thinking of one of ordinary skill in the art, guided only by the prior art references in the then-accepted wisdom in the field.” *See e.g., W.L. Gore & Assoc., Inc. v. Garlock, Inc.*, 220 USPQ 303, 313 (Fed. Cir. 1983).

#### **D. Arguments**

In the office action dated October 11, 2006, the Examiner rejects claims 1 – 14, 16 – 35 and 57 – 64 under 35 U.S.C. § 103 (a) as being unpatentable over U.S. Patent No. 6,254,766 to Sughrue et al., (hereinafter Sughrue). In support of this rejection, the Examiner asserts that Sughrue discloses each step of the claim processes, with one exception. Although admitting that “Sughrue does not disclose

including a promoter (or nickel) in the admixing step (a),” the Examiner goes on to allege that “it would have been *prima facie* obvious to one of ordinary skill in the art at the time the invention was made to have added such promoter to the mixture in the admixing step of (a) of Sughrue in order to achieve a promoted and effective catalyst composition, and in view of step (e) of the reference which teaches to impregnate the resulting calcined particulate with nickel.” Office Action page 3, lines 12 – 17. For at least the reasons detailed below, Applicants submit that the Examiner has failed to establish a *prima facie* case of obviousness based on Sughrue.

Applicants submit that the Examiner has failed to establish a *prima facie* case of obviousness because, for example, the prior art reference relied on by the Examiner, while being a significant contribution to the art, fails to teach or suggest each and every limitation of the claims of the present application. For example, independent claims 1 and 16 each recite the first step (a) of admixing a liquid, a zinc or metal containing compound, a silica containing compound, alumina, and a *promoter* to form a mixture thereof. In the Office Action, the Examiner concedes that the prior art does not teach or suggest this limitation. *See* Office Action, page 3, lines 12 – 13. Yet the Examiner contends that adding a promoter to the initial catalyst mixture would have been obvious to one of ordinary skill in the art because it creates a “promoted and effective catalyst composition.” Office Action, page 3, lines 12 – 17. Moreover, the Examiner contends that because Sughrue discloses impregnating a dried and calcined particulated mixture with a promoter, it would have been obvious to include the promoter in the initial mixture. However, the Examiner has pointed to nothing, either in the prior art of record, or in the knowledge of art generally, to

support these assertions. Thus, the Examiner appears to be relying solely on “common knowledge” in making this rejection. Applicants note that only “[i]n limited circumstances, it is appropriate for an Examiner to take official notice of facts not in the record or to rely on ‘common knowledge’ in making a rejection, solely on ‘common knowledge’ in the art without evidentiary support in the record, as the principle evidence upon which the rejection was based.” MPEP § 2144.03 (citing *Zurko*, 258 F.3d 1379, 1385, 59 USPQ 2d 1693, 1697 (Fed. Cir. 2001)). Therefore, the Examiner’s reliance solely on common knowledge cannot sustain a *prima facie* case of obviousness.

In addition, the Examiner has provided no evidence of a motivation to modify the process of Sughrue to include the step of admixing a promoter into the initial catalyst mixture. The mere fact that a reference *can* be modified does not render the results of modification obvious unless the prior art also suggests the desirability of the modification. *In re Mills*, 916 F.2d 680, 16 USPQ2d 1430 (Fed. Cir. 1990). Sughrue does not teach, suggest, or even contemplate that the promoter be admixed in the initial step of preparing the composition. Rather, Sughrue teaches that the “primary components,” zinc oxide, aluminum and silica, are combined into a “substantially homogenous mixture,” and the admixture is shaped into a particulate, which is dried and calcined before being impregnated with a nickel promoter. (*See* Sughrue, Col. 5, lines 1 – 40). Thus, Sughrue only discloses introducing the promoter *after* calcining and drying the particulate and does not teach or suggest that the promoter be admixed with the initial composition components. To a person not skilled in the art of chemistry, this difference might *seem* trivial. In fact, the process



of the present invention involves a fundamentally different chemistry than the process of Sughrue and would not be obvious to a person of ordinary skill in the art. For example, the liquid promoter in Sughrue is added to a composition that is chemically distinct from the individual zinc oxide, alumina and silica components with which the promoter is admixed in the present invention. This is because the process of Sughrue inherently involves the chemical transformation of the admixture components into an entirely different composition during the first drying and calcining step. Specifically, heat from the drying and calcining step would cause a chemical transformation of the zinc oxide, alumina and silica admixture resulting in a calcined particulate composition chemically distinct from the individual admixture components. X-Ray diffraction analysis of this calcined particulate confirms the presence of, for example, zinc aluminate. Thus, impregnation of the nickel promoter on the calcined particulate in Sughrue is not analogous to admixing the promoter with zinc oxide, alumina and silica as in the present invention, and involves the interaction of chemically different components from the process of the present invention. Thus, it cannot be said that the present invention is obvious in light of Sughrue and this rejection must be overcome.

Further, there will be no motivation in Sughrue to add the promoter in the admixing step, "in order to achieve a promoted and effective catalyst composition" as alleged by the Examiner, because Sughrue already reaches this result through impregnation. Moreover, there is nothing in the teachings of the prior art generally, or in the knowledge of persons of ordinary skill in the art that would teach or suggest modifying Sughrue to admix the promoter with the other components of the first step of preparing the catalyst composition. In catalyst preparation, admixing

and impregnation are fundamentally different procedures, and as the foregoing arguments suggest, a person of ordinary skill in the art would not interpret the impregnation step of Sughrue as teaching or suggesting that the promoter could alternatively be admixed in the initial step of the catalyst preparation. In particular, conventional teachings of the art at the time the invention was made teach away from admixing the promoter with the other catalyst components in the initial mixture. Rather, the art suggests that admixing the active catalysts component within the support will be unsuccessful compared to impregnating the support, which involves the depositing of the active catalyst component onto the *surface* of the support. Thus, persons of ordinary skill in the art would clearly understand that impregnating techniques typically facilitate higher dispersion of the active catalyst component, which allows for better contact with reactants. Conversely, it is well known in the art that admixing the active catalyst components within a support typically *decreases* dispersion, which in turn, would ordinarily decrease the effectiveness of the catalyst. Additionally, those having ordinary skill in the art would recognize that the hardness of the typical catalyst would ordinarily be weakened by admixing the active components in the support. Therefore, a person of ordinary skill in the art would have had no reasonable expectation of success for the proposed admixing modification, and would have understood impregnation, as disclosed in Sughrue, to be the prevailing and established technique for catalyst preparation. Accordingly, a person of ordinary skill in the art would have had no suggestion or motivation to modify Sughrue as suggested by the Examiner. Therefore, neither the teachings of the prior art, nor the knowledge of persons of ordinary skill in the art generally provide the requisite

motivation to modify the process of Sughrue to arrive at the invention claimed in independent claims 1 and 16. Because Sughrue does not expressly or implicitly teach or suggest each and every limitation of independent claims 1 and 16, it cannot be said to render the present invention obvious, and such rejection must be withdrawn.

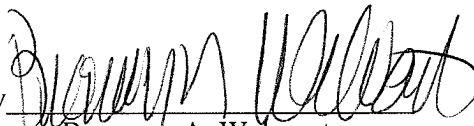
### Conclusion

For at least the reasons set forth above, the Examiner has failed, with regard to the rejections of independent claims 1 and 16 under 35 U.S.C. 103 (a) over Sughrue, to establish the requisite *prima facie* case of obviousness by identifying a prior art reference or combination of references that teach or suggest every limitation of those claims.

Accordingly, reversal of the Examiner's rejections is proper, and such favorable action is solicited.

Respectfully submitted,

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*Claims Appendix*

1. A method for the production of a composition comprising:
  - (a) admixing: 1) a liquid, 2) a zinc-containing compound, 3) a silica containing material, 4) alumina, and 5) a promoter so as to form a mixture thereof;
  - (b) drying said mixture so as to form a dried mixture;
  - (c) calcining said dried mixture so as to form a calcined mixture;
  - (d) reducing said calcined mixture with a reducing agent under conditions to produce a composition having a reduced valence promoter content therein; and
  - (e) recovering said composition.
2. A method in accordance with claim 1 wherein said calcined mixture is reduced in step (d) such that said composition will effect the removal of sulfur from a stream of hydrocarbons when such stream is contacted with same under desulfurization conditions.
3. A method in accordance with claim 1 wherein said promoter comprises a metal selected from the group consisting of nickel, cobalt, iron, manganese, copper, zinc, molybdenum, tungsten, silver, tin, antimony, vanadium, gold, platinum, ruthenium, iridium, chromium, palladium, titanium, zirconium, rhodium, rhenium, and combinations of any two or more thereof.
4. A method in accordance with claim 3 wherein said promoter comprises nickel.

5. A method in accordance with claim 1 wherein said silica-containing material is in the form of crushed expanded perlite.

6. A method in accordance with claim 1 wherein said mixture from step (a) is in the form of one of a wet mix, dough, paste, or slurry.

7. A method in accordance with claim 6 wherein said mixture from step (a) is in the form of a slurry.

8. A method in accordance with claim 1 wherein said mixture from step (a) is particulated prior to said drying in step (b).

9. A method in accordance with claim 1 wherein said mixture from step (a) is particulated in the form of one of granules, extrudates, tablets, spheres, pellets, or microspheres prior to said drying in step (b).

10. A method in accordance with claim 1 wherein said mixture from step (a) is particulated by spray drying in step (b) so as to form said dried mixture.

11. A method in accordance with claim 1 wherein said mixture is dried in step (b) at a temperature in the range of from about 65.5°C to about 550°C.

12. A method in accordance with claim 1 wherein said dried mixture is calcined in step (c) at a temperature in the range of from about 204.4°C to about 815.5°C.

13. A method in accordance with claim 1 wherein said calcined mixture is reduced in step (d) at a temperature in the range of from about 37.8°C to about 815.5°C and at a pressure in the range of from about 15 to about 1500 psia and

for a time sufficient to permit the formation of a reduced valence promoter.

14. A method in accordance with claim 1 wherein during said calcining of step (c) at least a portion of said alumina is converted to an aluminate.

15. A composition produced by the process of claim 1.

16. A method for the production of a composition comprising:

- (a) admixing: 1) a liquid, 2) a metal-containing compound, 3) a silica-containing material, 4) alumina, and 5) a first promoter so as to form a mixture thereof;
- (b) drying said mixture so as to form a dried mixture;
- (c) incorporating a second promoter onto or into said dried mixture to form an incorporated mixture;
- (d) drying said incorporated mixture so as to form a dried incorporated mixture;
- (e) calcining said dried incorporated mixture so as to form a calcined incorporated mixture;
- (f) reducing said calcined incorporated mixture with a reducing agent under conditions to produce a composition having a reduced valence promoter content therein; and
- (g) recovering said composition.

17. A method in accordance with claim 16 wherein said first promoter comprises a metal selected from the group consisting of nickel, cobalt, iron, manganese, copper, zinc, molybdenum, tungsten, silver, tin, antimony, vanadium, gold, platinum, ruthenium, iridium, chromium, palladium, titanium, zirconium,

rhodium, rhenium, and combinations of any two or more thereof.

18. A method in accordance with claim 16 wherein said first promoter comprises nickel.

19. A method in accordance with claim 16 wherein said calcined incorporated mixture is reduced in step (f) such that said composition of step (g) will effect the removal of sulfur from a stream of hydrocarbons when such stream is contacted with same under desulfurization conditions.

20. A method in accordance with claim 16 wherein said metal-containing compound comprises a metal selected from the group consisting of zinc, manganese, silver, copper, cadmium, tin, lanthanum, scandium, cerium, tungsten, molybdenum, iron, niobium, tantalum, gallium, indium, and combinations of any two or more thereof.

21. A method in accordance with claim 20 wherein said metal-containing compound comprises zinc.

22. A method in accordance with claim 16 wherein said second promoter is comprised of at least one metal selected from the group consisting of nickel, cobalt, iron, manganese, copper, zinc, molybdenum, tungsten, silver, tin, antimony, vanadium, gold, platinum, ruthenium, iridium, chromium, palladium, titanium, zirconium, rhodium, rhenium, and combinations of any two or more thereof.

23. A method in accordance with claim 22 wherein said second promoter comprises nickel.

24. A method in accordance with claim 16 wherein said silica-containing material is present in the form of crushed expanded perlite.

25. A method in accordance with claim 16 wherein said mixture from step (a) is in the form of one of a wet mix, dough, paste, or slurry.

26. A method in accordance with claim 25 wherein said mixture from step (a) is in the form of a slurry.

27. A method in accordance with claim 16 wherein said mixture from step (a) is particulated prior to drying in step (b).

28. A method in accordance with claim 16 wherein said mixture from step (a) is particulated in the form of one of granules, extrudates, tablets, spheres, pellets, or microspheres.

29. A method in accordance with claim 16 wherein said mixture from step (a) is particulated by spray drying in step (b) so as to form said dried mixture.

30. A method in accordance with claim 16 wherein said mixture and said incorporated mixture are each dried in steps (b) and (e), respectively, at a temperature in the range of from about 65.5°C to about 550°C.

31. A method in accordance with claim 16 wherein said dried incorporated mixture is calcined in step (e) at a temperature in the range of from about 204.4°C to about 815.5°C.

32. A method in accordance with claim 16 wherein the reduction of said calcined incorporated mixture in step (g) is carried out at a temperature in the range of from about 37.4°C to about 815.5°C and at a pressure in the range of from about 15 to about 1500 psia and for a time sufficient to permit the formation of a reduced valence promoter.



33. A method in accordance with claim 16 wherein during said calcining in step (e) at least a portion of said alumina is converted to an aluminate.

34. A method in accordance with claim 16 wherein said dried mixture from step (b) is calcined prior to said incorporating of step (c).

35. A method in accordance with claim 34, wherein said dried mixture is calcined at a temperature in the range of from about 204.4°C to about 815.5°C.

36. A composition produced by the process of claim 16.

37. A process for the removal of sulfur from a hydrocarbon stream comprising:

- (a) contacting said hydrocarbon stream with a composition produced by the process of claim 1 in a desulfurization zone under conditions such that there is formed a at least partially desulfurized hydrocarbon stream and a sulfurized composition;
- (b) separating said at least partially desulfurized hydrocarbon stream from said sulfurized composition thereby forming a separated desulfurized hydrocarbon stream and a separated sulfurized composition;
- (c) regenerating at least a portion of said separated sulfurized composition in a regeneration zone so as to remove at least a portion of the sulfur contained therein and/or thereon thereby forming a regenerated composition;
- (d) reducing said regenerated composition in a reduction zone so as

to provide a reduced composition having a reduced valence promoter content therein which will effect the removal of sulfur from sulfur-containing hydrocarbons when contacted with same; and thereafter

- (e) returning at least a portion of said reduced composition to said desulfurization zone.

38. A process in accordance with claim 37 wherein said hydrocarbon stream comprises a fuel selected from the group consisting of cracked-gasoline, diesel fuel, and combinations thereof.

39. A process in accordance with claim 37 wherein said desulfurization in step (a) is carried out at a temperature in the range of from about 37.8°C to about 537.8°C and a pressure in the range of from about 15 to about 1500 psia for a time sufficient to effect the removal of sulfur from said stream.

40. A process in accordance with claim 37 wherein said regeneration in step (c) is carried out at a temperature in the range of from about 37.8°C to about 815.5°C and a pressure in the range of from about 10 to about 1500 psia for a time sufficient to effect the removal of at least a portion of the sulfur from said separated sulfurized composition.

41. A process in accordance with claim 37 wherein air is employed in step (c) as a regeneration agent in said regeneration zone.

42. A process in accordance with claim 37 wherein said regenerated composition from step (c) is subjected to reduction with hydrogen in step (d) in said reduction zone which is maintained at a temperature in the range of from

about 37.8°C to about 815.5°C and at a pressure in the range of from about 15 to about 1500 psia and for a period of time sufficient to effect a reduction of the valence of the promoter content of said regenerated composition.

43. A process in accordance with claim 37 wherein said separated sulfurized composition from step (b) is stripped prior to introduction into said regeneration zone in step (c).

44. A process in accordance with claim 37 wherein said regenerated composition from step (c) is stripped prior to introduction to said reduction zone in step (d).

45. The cracked-gasoline product of the process of claim 38.

46. The diesel fuel product of the process of claim 38.

47. A process for the removal of sulfur from a hydrocarbon stream comprising:

- (a) contacting said hydrocarbon stream with a composition produced by the process of claim 16 in a desulfurization zone under conditions such that there is formed a desulfurized hydrocarbon stream and a sulfurized composition;
- (b) separating said desulfurized hydrocarbon stream from said sulfurized composition thereby forming a separated desulfurized hydrocarbon stream and a separated sulfurized composition;
- (c) regenerating at least a portion of said separated sulfurized composition in a regeneration zone so as to remove at least a portion of the sulfur contained therein and/or thereon thereby

forming a regenerated composition;

- (d) reducing said regenerated composition in an activation zone so as to provide a reduced composition having a reduced valence promoter content therein which will effect the removal of sulfur from a hydrocarbon stream when contacted with same; and thereafter
- (e) returning at least a portion of said reduced composition to said desulfurization zone.

48. A process in accordance with claim 47 wherein said hydrocarbon stream comprises a fuel selected from the group consisting of cracked-gasoline, diesel fuel, and combinations thereof.

49. A process in accordance with claim 47 wherein said desulfurization in step (a) is carried out at a temperature in the range of from about 37.8°C to about 537.8°C and a pressure in the range of from about 15 to about 1500 psia for a time sufficient to effect the removal of sulfur from said stream.

50. A process in accordance with claim 47 wherein said regeneration in step (c) is carried out at a temperature in the range of from about 37.8°C to about 815.5°C and a pressure in the range of from about 10 to about 1500 psia for a time sufficient to effect the removal of at least a portion of the sulfur from said separated sulfurized composition.

51. A process in accordance with claim 47 wherein air is employed in step (c) as a regeneration agent in said regeneration zone.

52. A process in accordance with claim 47 wherein said

regenerated composition from step (c) is subjected to reduction with hydrogen in step (d) in said reduction zone which is maintained at a temperature in the range of from about 37.8°C to about 815.5°C and at a pressure in the range of from about 15 to about 1500 psia and for a period of time sufficient to effect a reduction of the valence of the promoter content of said regenerated composition.

53. A process in accordance with claim 47 wherein said separated sulfurized composition from step (b) is stripped prior to introduction into said regeneration zone in step (c).

54. A process in accordance with claim 47 wherein said regenerated composition from step (c) is stripped prior to introduction to said reduction zone in step (d).

55. The cracked-gasoline product of the process of claim 48.

56. The diesel fuel product of the process of claim 48.

57. A method in accordance with claim 1, wherein step (a) further comprises admixing a second liquid, a second alumina, a second zinc-containing compound, and a second silica-containing material.

58. A method in accordance with claim 57 wherein the admixing of step (a) comprises the following steps:

- (1) admixing said liquid and said alumina so as to form a first mixture;
- (2) admixing said zinc-containing compound, said silica-containing material, said second alumina, and said first mixture so as to form a second mixture;

- (3) admixing said second liquid and said second silica-containing material so as to form a third mixture;
- (4) admixing said promoter and said third mixture so as to form a fourth mixture;
- (5) admixing said second mixture and said fourth mixture so as to form a fifth mixture; and
- (6) admixing said second zinc-containing compound and said fifth mixture so as to form a sixth mixture.

59. A method in accordance with claim 16, wherein step (a) further comprises admixing a second liquid, a second alumina, a second metal-containing compound, and a second silica-containing material.

60. A method in accordance with claim 59 wherein the admixing of step (a) comprises the following steps:

- (1) admixing said liquid and said alumina so as to form a first mixture;
- (2) admixing said metal-containing compound, said silica-containing material, said second alumina, and said first mixture so as to form a second mixture;
- (3) admixing said second liquid and said second silica-containing material so as to form a third mixture;
- (4) admixing said promoter and said third mixture so as to form a fourth mixture;
- (5) admixing said second mixture and said fourth mixture so as to form a fifth mixture; and

(6) admixing said second metal-containing compound and said fifth mixture so as to form a sixth mixture.

61. A method in accordance with claim 1 wherein said promoter is present in the composition in the range of from about 5 to about 40 weight percent based on the total weight of the composition.

62. A method in accordance with claim 1 wherein said promoter is present in the composition in the range of from 8 to 20 weight percent based on the total weight of the composition.

63. A method in accordance with claim 16 wherein the combination of said first promoter and said second promoter is present in the composition in the range of from about 5 to about 40 weight percent based on the total weight of the composition.

64. A method in accordance with claim 16 wherein the combination of said first promoter and said second promoter is present in the composition in the range of from 8 to 20 weight percent based on the total weight of the composition.

*Evidence Appendix*

None.



10/625,366  
34045US

*Related Proceedings Appendix*

None.